

GENERAL INFORMATION

Frank Zimmermann

FCC-ee Optics Design Meeting #197 & 68th FCCIS WP2.2 meeting, 14 November 2024

Upcoming events

- FCC SAC meeting #8, Cambridge/UK, 18-20 Nov 2024
- Other science opportunities at FCC-ee workshop, 28-29 Nov 2024, <https://indico.cern.ch/event/1454873/>
- FCC workshop EN Department, 28 November 2024
- Germany HEP Strategy meeting, DESY, 27-29 November
- End 2024: deadline first draft FCC FSR volume 2 (accelerators)
- 18th FCC Physics workshop at CERN, 13-17 January 2025
- End of March 2025, deadline for input to ESPPU
- FCC Week 2025, Vienna, 19-23 May 2025,

Feasibility Study Report for March 2025

Structure: Three Volumes

- **Vol. 1: Physics, Experiments and Detectors (~200 pages)**
- **Vol. 2: Accelerators, Technical Infrastructures, Safety Concepts (~400 pages)**
- **Vol. 3: Civil Engineering, Implementation & Sustainability (~200 pages)**
- **Executive Summary of the FCC Feasibility Study: ~40 pages**

Input for Update of European Strategy for Particle Physics

to be prepared with Overleaf & published by EPJ (Springer-Nature) – FCCIS members



In addition:

a. **Documentation on Cost Estimate – Funding Models**

FSR draft table of contents (1)

P. Charitos, M.
Benedikt, C. Carli,
J.-P. Burnet et al.

INTRODUCTION (~10 pages)

FCC-ee & hh Requirements & Design considerations (approaches & general brief introduction/principles)
FCC-ee & hh Layout and Key Parameters

1 FCC-ee Collider (40 pages)

1 FCC-ee collider design and performance
1.1 Beam-beam effects, parameter choices, and luminosity
1.2 Optics design and beam dynamics. .
1.3 Impact of misalignments and field errors
1.4 Collective effects
1.5 Collimation
1.6 Machine-detector interface (MDI)
1.7 Energy calibration and polarisation
1.8 Injection and extraction
1.9 Radiation environment
1.10 Ongoing studies
1.11 Ongoing studies and possible upgrades
1.12 Preliminary requirements on technical systems

1.2 Operation concept (20 pages)

1.2.1 Operation, and performance,
1.2.2+xx requirements (filling schemes, efficiency, physics goals, RF staging?, energy switching, beam-based alignment, luminosity tuning, injection requirements, beam diagnostics requirements)

1.2.3 Preliminary requirements on technical systems

1.3 Technical Systems (40 pages)

1.3.1 Main magnets
1.3.2 Vacuum system, electron-cloud mitigation, and radiation shielding
1.3.3 Radiofrequency systems layout, configurations, and parameters
1.3.4 Survey and alignment concepts and system
1.3.5 Beam Intercepting Devices (halo collimators, beam dump)
1.3.6 Beam Transfer Systems & Separator
1.3.7 Powering Systems
1.3.8 Beam diagnostics instruments (beam position, beam size/length, beam loss, beam current, polarization & spectrometry)
1.3.9 Control systems
1.3.10 Integration
1.3.11 Machine Protection

1.3.13 Dismantling

1.3.14 Preliminary requirements on technical infrastructure systems

split into pieces?

Collider operation concept now split

Chapter Operation concept

X.1 Operation and performance

X.1.1 Filling patterns

X.1.2 Bootstrapping injection scheme

X.1.3 Top-up injection

X.1.4 Refilling after abort

X.1.5 Switching between Z, WW, and ZH modes¹

X.1.6 RF upgrade for ttbar

X.2 Requirements

X.2.1 Physics requirements

X.2.2 Target availability and efficiency

X.2.3 Machine protection requirements

X.2.4 Alignment and field error tolerances

X.2.5 Beam-based alignment, optics correction, emittance and IP tuning

X.2.6 Beam diagnostics requirements

X.2.7 Injection requirements

X.2.8 Vacuum tolerances

X.3 Availability

X.3.1 Simulation Model

X.3.2 Performance of the Baseline Design

X.3.3 R&D Opportunities

X.4 Preliminary requirements on technical systems

FSR draft table of contents (2)

2 FCC-ee Booster (60 pages)

2.1 Design & Performance

- 2.1.1 Optics design and Beam dynamics (including synchrotron radiation and tapering)
- 2.1.2 Collective effects
- 2.1.3 Collimation
- 2.1.4 Injection and Extraction (top up injection)
- 2.1.5 Ongoing studies and possible upgrades

2.2 Operation concept

- 2.2.1 Operation, and performance,
- 2.2.2 requirements (filling schemes, efficiency, physics goals, RF staging, machine protection, alignment tolerances, field error tolerances, vacuum tolerances, optics corrections, emittance tuning..., injection requirements, beam diagnostics requirements)

2.3 Technical Systems

- 2.3.1 Main magnets
- 2.3.2 Vacuum system, electron-cloud mitigation and radiation shielding
- 2.3.3 Radiofrequency systems layout, configurations, and parameters
- 2.3.5 Survey and alignment concepts and system
- 2.3.4 Beam Intercepting Devices (halo collimators, beam dump)
- 2.3.5 Beam Transfer Systems & Separator
- 2.3.6 Beam diagnostics instruments (beam position, beam size/length, beam loss, beam current, polarization & spectrometry)
- 2.3.7 Control systems
- 2.3.8 Integration
- 2.3.9 Machine Protection
- 2.3.10 Dismantling

3 FCC-ee Injector Complex (30 pages)

- 3.1 Injector Overview
- 3.2 Electron Gun
- 3.3 Electron Linacs
 - 3.4 Positron source and linac
- 3.5 Damping Ring
- 3.6 High-Energy Linac
- 3.7 Energy Compressors
- 3.8 Transfer Lines
- 3.9 Technical Infrastructure
- 3.10 Civil Engineering
- 3.11 Ongoing studies and possible upgrades

4 FCC-hh ??

5 FCC Technical Infrastructure (~110 pages)

- 5.1 Requirement and design considerations (#5-10)
- 5.2 3D Integration Studies (#15-20)
- 5.3 Cooling and Ventilation (#10-15)
- 5.4 Power consumption and electricity distribution (#15-20)
- 5.5 Cryogenic systems (#15)
- 5.6 Transport and Robotics (#10-15)
- 5.7 Communication, computing and data services (#5-10)
- 5.8 Geodesy & Survey (#10-15)

6. Safety Concepts (30 pages)

- 6.1 Regulatory Framework (#3)
- 6.2 Safety Goals and Objectives (#5)
- 6.3 Hazard Registry (#3-5)
- 6.4 Safety Concepts for CE Construction Phase (#5-10)
- 6.5 Safety Concepts for Machine Installation Phase (#5-10)
- 6.6 Safety Concept for Operation Phase (#5-10)

Today's agenda

16:00 → 16:15 **General Information**

Speaker: Frank Zimmermann (CERN)

🕒 15m



16:20 → 16:40 **Vertical Instability study for FCC-ee (Z) due to beam-beam in presence of transverse wakefields**

Speaker: Roxana Soos (Université Paris-Saclay (FR))

🕒 20m



16:45 → 16:55 **Review of tapering for FCC-ee**

Speaker: Kevin Daniel Joel Andre (CERN)

🕒 10m

